Simulation and Operation of EV Charging Resources in Freight Systems (Technical Paper)

Reducing Depression Caused by the Abuse of Dopamine Receptors (STS Paper)

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis -Related Assignments

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Introduction

It is inherent to human nature to seek pleasure and avoid pain (Bergland, 2020). As technology continues to develop, accessibility to pleasure has become easy and instant, causing increased rates of depression and anxiety. This concept is known as compulsive overconsumption (Smith 2023). In this paper, the goal is to determine effective methods to combat compulsive overconsumption and regain control over negative emotions. This issue will be primarily addressed from the individual's point of view, but will also consider other stakeholders like large commercial organizations and the government. Mandating changes at the organization level is unrealistic, due to the current state of our sociotechnical world and the nature of U.S. capitalism. The organization level will still be explored, but this is the reason the individual level will be the focus.

Psychiatrist Dr. Anna Lembke describes mental health balance as a see-saw with pleasure and pain on either side (Lembke, 2021). The more the see-saw is “balanced”, the healthier one’s mental health is. Throughout practically all of mankind, the mental balance of pleasure and pain has been achievable, without being toppled in either direction. The neurochemical breakdown of how this functions is quite simple. When we experience something enjoyable, our brains release the “feel-good” chemical called dopamine, which gives ourselves a feeling of pleasure. This feeling is shortly followed by pain, caused by the “come-down”, which motivates us to continuously seek sources of pleasure (Hu & Nguyen, 2022).

However, technological advancement up to the present has begun to tip the pleasure-pain scale. Access to dopamine fixes has been and only will continue to increase. The addition of smartphones and social media in our lives are especially examples of this. In her book Dopamine

Nation, Lembke calls smartphones the “modern day hypodermic needle” (Lembke, 2021, p. 1), meaning we are constantly turning to our phones for quick hits of validation or distraction with those easy social media interactions, like swiping on and liking posts. This extends to online betting, e-shopping, pornography, and streaming shows. Humans’ brains are being rewired to use every spare second as an opportunity to be stimulated (Waters, 2021). Smartphones are only the tip of the iceberg. Whether it’s listening to music through airpods, watching a show on a streaming service, purchasing and drinking alcohol or using recreational drugs at the local convenience store, or making a cup of coffee in the morning, it has gotten so easy to satisfy the feel-good craving.

Why is this important? The more we abuse our dopamine receptors, the more unhappy overall we become, and the data backs it up. Over the past 30 years, global depression rates have shot up, and even more so in high-income countries in the past decade (Lembke, 2021). Furthermore, allowing ourselves to give in to the short-attention span urges literally changes how the brain is used. The obsession with instant gratification causes people to “live in their limbic brain”, which processes emotions, rather than the prefrontal cortex, which focuses on long-term planning and critical thinking skills (Lembke, 2021). Using both of these parts of the brain are essential for allowing a healthy and complete development of one’s personality.

The reason society has progressed to this point is pretty self-explanatory. Why is Starbucks so profitable? They sell specialized caffeinated drinks. Caffeine is regularly consumed by 90% of Americans and 8% meet the criteria for caffeine use disorder (United Brain Association, 2022). Why is TikTok so profitable? They capitalized on the social media constant-stimulation craving by creating an app that displays an endless stream of short videos hand-picked for each user based on their algorithm. Why are Apple and Microsoft the 2nd and

3rd most profitable companies worldwide (Statista, 2023)? Because one of their primary products are smartphones, which is where the feel-good compulsion stems from (Lembke, 2021). The competitive environment of capitalism in the US causes commercial companies to try to find a way to profit more than their competitors. The companies that took advantage of the human weakness of craving pleasure like Starbucks, TikTok, Apple, and Microsoft have consequently profited exponentially compared to their competition. Combining the business and psychological aspect of human's abusing sources of pleasure, this paper will look into how society can lower depression rates without financially impairing these companies.

STS Topic

To frame my analysis, I will use the concept of technological determinism (Kline 2001). To put it simply, this framework suggests that technology influences the social factors of our lives. An example of this in terms of this paper: smartphones influence the way we interact with one another, by increasing digitized communications through text messages, phone calls, and facetimes. Technological determinists, whether optimistic or pessimistic, argue that the impact of technology on our lives is inevitable, and its consequences will be "far-reaching" (Oxford Reference 2023). This concept originated in the 19th century, with a majority of strong supporters being critics of the influence of technology on society (Kline 2001). This framework would agree with the claims made so far. The technology of smartphones and social media (and much more) has impacted the social factors of happiness levels in our society. Like the claim made in the Oxford Reference, the impact of technological advancement in our lives was

inevitable due to the nature of capitalism, and the effects of continuously increasing depression rates as we further progress are indicators of the far-reaching consequences.

Research Plan

Primarily, I would research psychological methods to cope with the anxiety and depression caused from the abuse of dopamine receptors. Research will be done to determine what strategies have been proven to benefit mental health, specifically in terms of dealing with addictive tendencies. To complement the research, anecdotal evidence will also be collected through online surveys, to gain access into what people think causes them anxiety and their most effective means of combating it. Hopefully this strategy would gain not only answers on effectively "dopamine detoxing", but also ways to incentivize the behavior.

On the other hand, I would research business practices, look into alternatives to develop less-addicting products without decreasing profits (or increasing if possible). Try to find next steps like Apple and Microsoft to continue the technological advancement of their products in a way that induces less of the pleasure cravings. The business-side of the research could very likely yield minimal or no results, as it would be difficult to increase sales for a product that would be used less often.

The government is also a stakeholder to be considered. It is becoming more realistic in coming years that various technology-related addictions will be taken more seriously, and could involve government regulations. I would research what elements of smart devices, social media, etc. could legally be altered to lower unnecessary addictive features. However, it is controversial

to have the government step in and tell these large technology companies what their products can and cannot contain, as issues of limiting free speech and hindering the free market may arise.

Technical Topic

The Port of Virginia (POV) is responsible for transporting 3.6 million shipping containers per year (Virginia Port Authority 2023). For the past six years, UVA Systems Engineering students have been working with the POV to assist in optimizing port operations through the use of a simulation software called Simio. The goal of the project this year is to optimize worker and UTR (vehicle that transports one shipping container at a time throughout the port) utilization rates, through the implementation of electrical UTRs instead of diesel-powered UTRs. This change is intended to decrease the pollution output produced by the port.

At the port, shipping containers can arrive by ship, train, or truck. The containers that arrive via the container ships are unloaded by crane, which are then transported to a temporary storage area called “stacks”. From the stacks, the UTRs transport containers that are being picked up, whether that means delivering it to a truck or train. This process is bidirectional. Containers also arrive via truck and train, and make their way through the process in a reverse order until it reaches the container ships. This is the baseline of what our simulation models.

During the year so far, we have continuously added capabilities that more accurately mimic the port operations and test out altering parameters that are of interest to our client, such as charging time for the electrical vehicles (EVs), amount of charging stations, UTR speed, container arrival rate, amount of workers and UTRs available, etc. From there, the metrics of

interest are primarily worker and UTR utilization rates, as our client wants to maximize the usage he gets out of people/vehicles he has working for him.

We have weekly meetings with our client, the Vice President of Port Operations, Dan Hendrickson. In these meetings, we present progress reports on work done in and out of Simio, and receive feedback on what aspects are and are not worth continuing down. This structure has allowed us to fine tune our simulation models, python code, and literature review to most accurately reflect the desires of the client.

The goal from this point is to incorporate a charging/discharging component to the electrical vehicles in the simulation, in order to determine the optimal strategy to maximize the amount of time UTRs are able to operate and minimize charging time. By the end of the year, we hope to provide a strong recommendation on how to best make the switch from fuel-powered vehicles to electrically-powered vehicles.

Conclusion

In terms of dopamine-related addictions, I plan to have researched strategies at an individual, corporate, and government level that best help people to regain control over their lives and mental health. Access to easy dopamine “fixes” will only increase with time, so it is essential for this issue to be dealt with in a time-sensitive manner. People deserve to live their lives fully without the heavy blanket of anxiety and depression weighing down on them. At the minimum, I hope my research will at least help me gain the knowledge that I can spread to my

close friends and family on how to combat short-term pleasure in terms of long-term balance, to live my life up to its fullest potential.

By the end of the year, my group will have a plan and model for the Port of Virginia to use on how to implement EVs as cost efficiently as possible. Beyond that, the simulation can be used to experiment with changing other parameters - to see where the port could cut costs without hindering productivity, or where the port may need to invest more resources as times change. As a group of systems engineers, we hope to gain the real-world experience of working alongside a client to help problem solve. This is an essential skill to have in this major, as 80% of systems students work as consultants after graduation.

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